Morphologic and genetic differentiation of natural populations of *Chrysichthys nigrodigitatus* (Siluroidei, Claroteidae)

Béatrice Adépo-Gourène
Geneticist

Guy G. Teugels
Ichthyologist

Jean François Agnèse
Geneticist

Introduction

Chrysichthys nigrodigitatus (Lacépède, 1803) is a silurid found in most of the West African hydrographic basins from Senegal to Zaire. It is an economically important species whose culture in lagoons has been developed in certain countries like Côte d'Ivoire, where the annual production is 350 to 400 t (OTEME, 1993). But as for most fish species of aquacultural interest, the research programs which studied the biological cycle, the production conditions and the commercialization of the species did not take into account the genetic resources of the natural populations. However, the biological characteristics of the populations including their reproduction, depend in part on their genetic patrimony. The knowledge of genetic characteristics of fish species of aquacultural interest is necessary to characterize the strains and the populations and also to show introgressions (hybridization between close species). It also allows the determination of management schemes (maintenance, study and restoration of the genetic variability of strains, reconstitution of stocks in the natural environment) and improvement plans (comparison of performances of genetically differentiated strains) and finally to create new strains by crossing. The first genetic studies of *C. nigrodigitatus* populations were carried out by AGNESE in 1989 during a study on the genetic differentiation of several West African siluriform species of interest to fisheries and aquaculture. These first works showed that the population from the Niger river (Mali) is very differentiated from those coming from rivers in Côte d'Ivoire. The current work studies the diversity of natural populations of *C. nigrodigitatus* over a larger portion of its distribution range. Two techniques were used to

Results and discussion

The morphological data obtained for fourteen characteristics, excluding the total length, were subjected to an analysis of principal components; the populations were divided into four groups based on their country of origin (Fig. 2). The nasal barbel length is the most discriminating characteristic on the second axis. The dorsal length, the premaxillary band width and the occipital process length are the most discriminatory on the third axis. The first axis was not taken into account because it was highly influenced by specimen size. Samples from Congo and Côte d'Ivoire were clearly separated from those of Senegal and Mali. There is a great deal of overlapping in the zone occupied by the Congo sample, taken from brackish water near the mouth of the Kouilou, and samples from Côte d'Ivoire. This overlapping is seen particularly with populations from Ebrié Lagoon (Layo, Jaqueville and Bonoua).

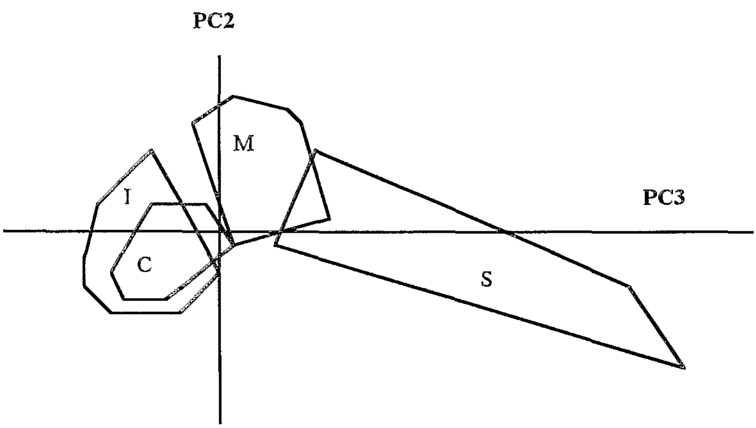

Figure 2
Plot of a principal component analysis using 14 log-tranformed metric variables of *Chrysichthys nigrodigitatus* specimens arranged in groups based on their country of origin: I, Côte d'Ivoire, M, Mali, C, Congo, S, Senegal.

Populations from Mali and Senegal overlap slightly. Concerning meristic characterisitics, only the number of branchiospines on the lower part of the first branchial arch and the number of branched rays in the anal fin showed some variation. The Congo population distinguishes itself from the others by a greater number of branchiospines (15 to 18) and branched rays.

Genetically, of the 19 loci analyzed by enzymatic electrophoresis, 6 were shown to be polymorphic in the *C. nigrodigitatus* samples. The Congo and Senegal samples were monomorphic for all loci studied (Table 1). Those from Layo and Jacqueville showed private alleles EST-1*A and PROT*B. The polymorphism rate, P99, [redacted] number of brooders used but also the systematic introduction of new wild brooders helps maintain the genetic variability of the original population.

The results obtained using these two techniques show certain similarities. All the *C. nigrodigitatus* populations, with the exception of those from Côte d'Ivoire and Congo, were different morphologically. This differentiation was ordained geographically. In effect, the populations the most differentiated are those which were the most geographically separated (Senegal-Mali and Congo).

Concerning the genetic differentiation, the most polymorphic populations were those from Côte d'Ivoire and the monomorphic populations were located at the limits of the species' distribution (Senegal and Congo).

Conclusion

Knowledge of the genetic diversity of natural populations allows the monitoring of natural stocks the conservation of which may become necessary due to manmade environmental alterations.

From an aquacultural viewpoint, knowledge of the genetic diversity of wild populations allows for appropriate choices in sampling sites and eventual crosses in order to obtain strains with high genetic variability. For example, the Senegal and Congo strains being monomorphic sometimes for different alleles, it would be interesting resistance to disease as well as to other environmental aggressions, etc...) because of its high genetic variability. In effect, different studies (DAZMANN *et al.*, 1986, 1987, 1988, 1989; MITTON and GRANT, 1984; ALLENDORF and LEARY, 1986; ZOUROS and FOLTZ, 1987; 1990; AGNESE *et al.*, 1994) of the relationships between the [redacted]

References

AGNESE (J.F.), 1989 — *Différenciation génétique de plusieurs espèces de Siluriformes ouest-africains ayant un intérêt pour l'aquaculture.* PhD Thesis, Université [illegible]

of growth in developmental rate in rainbow trout. *Physiol. Zool.*, 60 (2): 211-220.

DANZMANN (R.G.), FERGUSON (M.M.), [illegible]